Studying Avian Biodiversity Changes after Wetland Restoration: A Novel Approach via Remote Sensing and Citizen Science

Sivakumar, Ashwin (School: Flintridge Preparatory School)

Wetlands are important wildlife habitats, but are severely threatened and need to be preserved and restored. This study developed a powerful, low-cost, and reusable methodology to assess avian population response after a wetland restoration, combining for the first time, remote sensing satellite imagery, geospatial climate data, and citizen science bird observations. The methodology was validated on the Fernhill Wetlands restoration site in Oregon. 1.7 terabytes of LANDSAT-8 and SENTINEL-2 satellite images and PRISM climate datasets from 2013-2018 were imported and processed in Google Earth Engine. Quantitative indices for vegetation, water area, and climate were then derived for pre- and post-restoration periods. Correlations were established in R between these indices and 146,457 observations in the eBird database. Finally, supervised classification was used to obtain clarity on land, vegetation, and water changes at Fernhill. Several terrestrial species and deep-water ducks correlated well with vegetation and water indices. Species living at the water's edge showed subtler and sometimes unexpected reactions to habitat change. Dabbling ducks showed no correlation to the indices, prompting follow-up investigations that revealed conflicting inter-species effects. The new technique showed positive habitat restoration impact on several species as hypothesized while highlighting unexpected signals and relationships not detected in previous studies. Importantly, subtle behavioral differences among species, even within a category, could significantly influence response to habitat change. This technique is low-cost due to the use of free datasets and tools. It is reusable and allows for powerful and effective ongoing monitoring of wetland habitats.

Awards Won:
Fourth Award of $500